

Phonological conditions on Tagalog adjective-noun word order*

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1 INTRODUCTION TAGALOG ADJECTIVE/NOUN PAIRS

- Both orders are possible and claimed to be semantically interchangeable = “without any apparent difference in meaning” (Schachter & Otnes 1972: 122):

(1) magandá-ng babáe ~ babáe-ng magandá Kroeger 1998
 beautiful-LINK woman woman-LINK beautiful ‘beautiful woman’

- Elsewhere, it’s been shown that word order variation can be conditioned by numerous factors
 - phonological, syntactic, semantic, usage-based, psycholinguistic, sociolinguistic (e.g., McDonald et al. 1993; Wasow 2002; Wright, Hay & Bent 2005; Benor & Levy 2006; Brennan et al. 2007; Anttila et al. 2010; and references therein).
- Some previous suggestions, based on casual observations, of factors that might condition adjective/noun order in Tagalog:
 - Schachter & Otnes: semantic factors such as givenness or adjective semantic class.
 - Donohue (2007:360): phonological factors (versus syntactic factors)
- Both sources acknowledge that adjective/noun ordering variation cannot be systematically accounted for by any single predictor alone.

❖ What factors (if any) condition Tagalog adjective/noun word order variation?

- An additional wrinkle:
- The “linker” morpheme, attached to first word, has phonologically conditioned allomorphs:

(2) a. If word ends in V, add *ng* ([-ŋ]): babáe → babáe-ng ‘woman’
 b. If word ends in /n/ or /ʔ/, change it to *ng* ([ŋ]): karaniwan → karaniwa-ng ‘ordinary’
 c. If word ends in any other C, add [na]: itím → itím na ‘black’

❖ Do factors that condition word order variation depend on the phonological (surface) form of the linker?

1.1 This talk

- Large-scale corpus study investigating factors affecting adjective/noun order.
- As far as we know, this is the first systematic study of Tagalog adjective/noun order variation.
- In particular, we focus on phonological factors that may affect order, including segmental and prosodic well-formedness conditions.

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Results

- In addition to semantic and usage-based factors, phonological conditions influence adjective/noun word order in Tagalog.
- Word order is conditioned in part by the phonological surface form of the linker particle.
 - ↳ Word order can optimize phonological well-formedness see also Schlüter 2005; Shih 2014.
 - ↳ Phonological (surface) information is available at the point of word order choices.
- Theoretical implications of our results:
 - for understanding the role of phonology in determining word order, and
 - for considering the design of the interface between phonology, morphology and syntax in both formal grammatical models and psycholinguistic models of language production.

2 DATA

2.1 Tagalog Web Text Corpus from Zuraw 2006

- Web text from 2004, variety of genres
- 47,144,971 word tokens, 105,464 word types

2.2 Adjective/noun pair extraction

- Nouns and adjectives automatically and manually extracted from part-of-speech tags on the SEAsite online Tagalog-English dictionary (SEAsite 2001).
- Searched corpus for all possible noun-linker-adjective and adjective-linker-noun sequences.
- Automatic exclusion of pairs in the following circumstances:
 - instances wherein the second word potentially had a *ng* linker
 - instances with punctuation occurring between the two words
 - instances where a noun or adjective must bear a certain affix according to the Seasite Dictionary but does not
 - instances with the following tokens: *alám*, *am*, *dápat*, *habang*, *hanggáng*, *lamáng*, *saíd*, *sayá* (*ng*), *tápos*, *tódo*(*ng*), *úpang*¹
- Adjective/noun pairs hand-checked by three Tagalog-English bilinguals:
 - 1,205 noun/adjective pairs (types) were selected, to include the nouns and adjectives occurring most frequently in the set, as well as the most-frequent pairs.
 - 11 words identified as problematic: adverbs rather than adjectives; ambiguities caused by linker (e.g., *noóng* could be *noó-ng* ‘forehead’ + linker, or *noóng* ‘when-past’).
 - Adjective/noun pairs containing any problematic words were excluded.
- Words’ stress patterns manually obtained from a paper dictionary (English 1986).
- 149,689 adjective/noun pair tokens, 14,591 types
- 1,708 noun types, 587 adjective types
- Some caveats = potential sources of noise:
 - *X-linker-Y* might not form a constituent: *Y* may be part of a complex modifier.

¹ *Am* (e.g., versus PM) and *said* were excluded as English words. The rest are more commonly used as verbs (*alam*, *dapat*), prepositions (*habang*, *hanggang*, *tapos*, *upang*), quantifiers (*todo*), or enclitics (*lamang*, *saya*).

- (3) a. *táo-ng armádo* ‘person-LINK armed’
 b. *táo-ng armádo sa kanilang ika-apat na henerasyon mobile na aparato*
 ‘person- LINK armed with their fourth LINK generation mobile LINK device’

- We don’t know which pairs are predicates and which are not (claimed to be important by Schachter & Otnes 1972).
- We don’t know if either of the words is focused or represents new information, etc. (though we hope to add givenness information in future versions of the corpus).

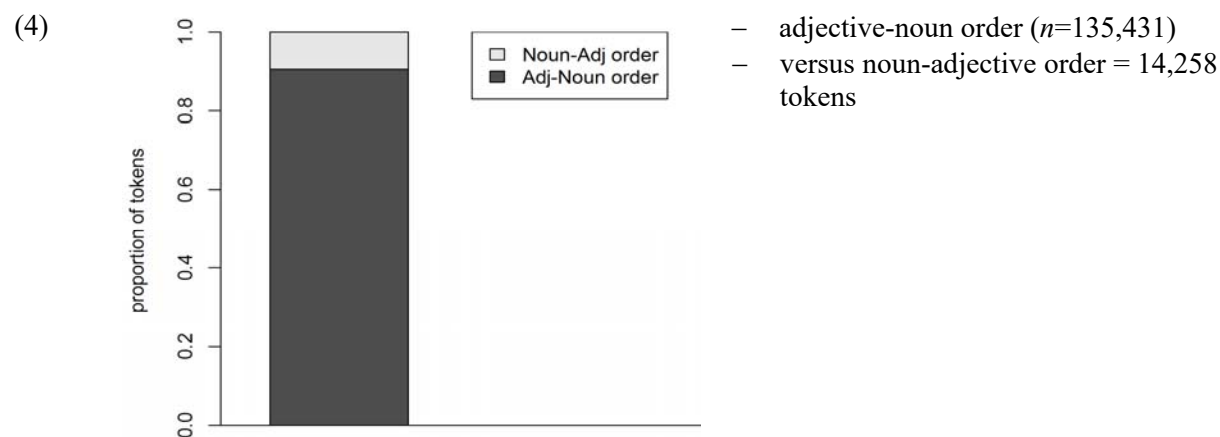
3 METHODOLOGY

- Mixed-effects regression model using `glmer()` from `lme4` R package (Bates et al. 2013; R Core development team):
 - Multivariate analysis controls for numerous predictors at once.
 - Data: unique adjective/noun combinations ($n = 14,591$)
 - Dependent variable: log odds of non-default, postnominal noun-adjective order
 - Positive coefficient indicates increased probability of noun-first order.
 - Negative coefficient indicates decreased probability of noun-first order.
 - Predictors were centered; numerical predictors also standardized (following Gelman & Hill 2007; Gelman 2008).
 - Random intercepts: noun, adjective
- Independent variables, culled from previous studies of word order variation, descriptions of Tagalog adjective/noun word order, Tagalog phonology, cross-linguistically common phonological behaviors (see §4.3).
 - segmental and prosodic phonological predictors
 - non-phonological predictors

4 GENERAL RESULTS

4.1 “Default” order

- Adjective-noun order is overwhelmingly preferred = “default” order



- (9) Warlmanpa (Pama-Nyungan, Australia) reflexive marker /-nyanu/ follows person/number clitics, except when a sequence of adjacent identical nasals would be formed (Wolf 2008:228).

- a. -na-nyanu
1P-REFL
b. -nyanu-n *-n-nyanu
REFL-2P

- Root-internally in Tagalog, nasal-nasal sequences are underrepresented:
 - In 4,294 native, disyllabic roots (from English 1986), 1,257 have a medial cluster.
 - Of those, 659 have nasal as the first consonant, and 66 have a nasal as the second consonant.
 - Thus, we expect 35 nas-nas medial clusters if consonants combined freely, but find only 2:

lingming ‘confused’
pangnan ‘basket’

- Tagalog word order results: [nasal] + [nasal] sequences involving [m, ŋ] + *na* linker are dispreferred.
- ↳ Avoid [m, ŋ]-final adjective in first position, which takes linker *na*.
 - ↳ e.g., Noun-adjective order is 13.69% more likely when adj is nasal-final.

- (10) pelúka na itím > itím na pelúka
wig LINK black black LINK wig ‘black wig’

- In contrast, root-internal velar-velar sequences aren’t underrepresented in Tagalog:
 - 497 clusters have velars as the first consonant, 165 have velars as the second.
 - Thus, we expect 65 velar-velar sequences, and in fact find 152 (e.g., mostly *ngg* and *ngk*).
- Tagalog word order results: [velar]+[velar] sequences were tested but found to be not significantly dispreferred in alternative word order.

5.1.2 Contextual markedness: *NÇ

- Cross-linguistically, NÇ clusters can trigger a number of phonological repairs (e.g., deletion, assimilation, fusion; Pater 1996, Pater 2001).
- The *NÇ constraint Pater 1996, Pater 2001; Hayes & Stivers 1996) is active at Tagalog prefix-stem boundaries, as in many related languages (see Zuraw 2010 for more):

- (11) A stem-initial voiceless obstruent usually fuses with a preceding nasal, but a voiced obstruent usually does not.

- a. /ma-paŋ-kamkám/ → [ma-pa-ŋamkám] ‘rapacious’
b. /paŋ-diníg/ → [pan-diníg] ‘sense of hearing’

- Tagalog word order results: Avoid linker -*ng* + voiceless-initial noun.

- (12) péra-ng nakalaán > nakalaá-**ng** **péra**
money-LINK dedicated dedicated-LINK money ‘dedicated money’

5.1.3 Morphophonological alignment and syllable structure effects

- Hiatus avoidance and ONSET Prince & Smolensky 2004:17 affects binomial ordering of name pairs in English (Wright et al. 2005; Benor and Levy 2006; a.o.)

(13) John and Yoko > Yoko and John

- Morpheme boundaries prefer to coincide with syllable boundaries.
 - e.g., ALIGN(Stem, Right; Syllable, Right) for Axininca Campa, Lardil, Hebrew, Bedouin Arabic, and Kamaiurá (McCarthy & Prince 1993).
 - Alignment between syllable boundaries and higher-level boundaries can affect ordering of syllables in these cases as well: e.g., choice between [na.ta] and *[ta.na] in Axininca Camp depends on ALIGN-L.
- Word-internally in Tagalog, resyllabification is rare, too, and does not happen across e.g., prefix-stem boundaries (example from Schachter & Otnes 1972:19):

(14) mag- + ²alis ‘departure’ → mag²alis ‘remove’ *[magalis]²

- Tagalog word order results: vowel-initial adjectives prefer to be initial, avoiding morphophonological alignment, resyllabification, and/or glottal stop insertion second position:

↳ Avoid noun + *na* linker + V-initial adjective, which would result in glottal stop insertion.

(15) *espesyál na bágay* > *bágay na ²espesyál*
 special LINK thing thing LINK special ‘special thing’

↳ Avoid noun + *ng* linker + V-initial noun, which would result in resyllabification/misalignment.

(16) *ordináryo-ng táo* > *táo-ng ordináryo*
 ordinary-LINK person person-LINK ordinary ‘ordinary person’

5.2 Prosodic phonology results

5.2.1 Weight/length

- Heavier/longer constituents tend to come at the peripheries (Behagel 1909; Quirk et al. 1985; Hawkins 1994; Wasow 2002; a.o.).
 - In English, heavier/longer constituents come last. In V-final languages like Japanese, heavier/longer constituents tend to come first Hawkins 1994.
 - Numerous proposals for the underlying cause of heavy-to-edge phenomena include processing-based Gibson 2000; Temperley 2006, syntactic (e.g., Wasow 2002), and prosodic explanations (Zec and Inkelas 1990; Zubizarreta 1998; Anttila et al. 2010; a.o.; see Szmrecsányi 2004; Grafmiller & Shih 2011 for empirical comparisons of these proposals).
- (17) “Heavy-last” in genitive syntactic variation in English (e.g., Rosenbach 2005; Hinrichs & Szmrecsányi 2007; Grafmiller & Shih 2011; Shih et al. 2015):

² The word *magalis* does appear as a word in Tagalog, meaning ‘full of sores’ (presumably not derived from ²*alis* in this case).

- a. [the attitude]_{NP} of [people who are really into classical music and feel that if it's not seventy-five years old, it hasn't stood the test of time]_{NP} >
 b. [people who are really into classical music and feel that if it's not seventy-five years old, it hasn't stood the test of time]_{NP}'s [attitude]_{NP}
- Tagalog word order is usually VSO and, like English, heavy-last is expected (cf. Japanese).
 - e.g., Relative clause order is variable, but Schachter & Otnes 1972 note a “tendency to prefer the order head-linker-modifier when the modifying phrase is long.”
- (18) ang pagkái-ng nilúto mo > ang nilúto mo-ng pagkáin (S&O 1972: 123)
 DET food-LINK cooked you DET cooked you-LINK food ‘the food you cooked’
- Tagalog word order results: Results here, however, demonstrate a different effect: long words (with more segments) tend to prefer canonical, “default”, adjective-noun order³. (Also tested syllable count with the same result.)
- ↳ Longer nouns prefer default second position.
- (19) dakíla-ng kapangyaríhan > kapangyaríha-ng dakíla?²
 great-LINK power power-LINK great ‘great power’
- ↳ Longer adjectives prefer default first position.
- (20) pansamantalá-ng lúpon > lúpo-ng pansamantalá
 temporary-LINK committee committee-LINK temporary ‘temporary committee’
- ↳ Interaction for long nouns and long adjectives, even more “default” effect: longer nouns and adjectives prefer adjective-noun order.
- (21) pangunáhi-ng katotohánan > katotohána-ng pangunáhin
 basic-LINK fact fact-LINK basic ‘basic facts’
- Possible explanation (for future inquiry):
 - default order may remove the cognitive uncertainty of adj-noun word order variation when processing heavy constituents (akin to information smoothing: e.g., Frank & Jaeger 2008).

5.2.2 Rhythm

- Stress clashes are avoided via alternative word order in English (see also Temperley 2009):
- (22) Clash avoidance leads to avoidance of *a*-adjectives in prenominal positions in diachronic change in English Schlüter 2005.
- a. $\acute{\sigma}$ σ σ σ σ $\acute{\sigma}$ σ $\acute{\sigma}$ $\acute{\sigma}$ σ
 the **pérson** who was **awáre** > ?the **awáre pérson**
- b. > σ $\acute{\sigma}$ $\acute{\sigma}$ σ
 > ??the **asléep pérson**

³ cf. Donohue 2007:360, fn 11, who observes that “relative length” affects order.

- Stress lapses are avoided via alternative word order in English:
- (23) Genitive alternation (e.g., Shih et al. 2015; Shih 2014; see also binomial pair ordering: McDonald et al. 1993; Wright et al. 2005; Benor & Levy 2006)

$\acute{\sigma} \sigma \quad \acute{\sigma} \sigma \sigma$ $\acute{\sigma} \sigma \sigma \sigma \sigma \quad \acute{\sigma} \sigma$
 the sýstem's b́enefits > the b́enefits of the sýstem

- Background: Tagalog primary stress is contrastive: final, penultimate; in some loans, antepenultimate.
 - Stressed non-final vowels are notably longer than unstressed.
 - Secondary stress is not fully understood for Tagalog (French 1988; French 1991).
 - Usually not included in dictionary; we did not attempt to annotate for it
- Tagalog word order results: Looking at data subset of di- and tri-syllabic words only (since rhythmic measures are correlated with word length), trends in data towards clash and lapse avoidance.
- Primary stress clashes are avoided.

(24) $\acute{\sigma} \sigma \quad \sigma \acute{\sigma} \quad > \quad \sigma \acute{\sigma} \quad \acute{\sigma} \sigma$
 b́aya-ng sawí? > sawí-ng b́ayan ‘unfortunate
 country-LINK unfortunate unfortunate-LINK country country/people’

- Long primary stress lapses (3 or more unstressed syllables) are avoided.

(25) $\sigma \sigma \acute{\sigma} \quad \sigma \quad \acute{\sigma} \sigma \quad > \quad \acute{\sigma} \sigma \sigma \quad \sigma \sigma \acute{\sigma}$
 espesyál na áraw > áraw na espesyál
 special LINK day day LINK special ‘special day’

6 RESULTS: NON-PHONOLOGICAL PREDICTORS OF ORDER

6.1 Prototypical adjectives

- Prototypical items are more easily accessed, and tend to come first in word order (Kelly et al. 1986).
 - In Tagalog, adjectives are often formed from *ma-* prefix (e.g., *ma-baho* ‘malodorous’ from *baho* ‘bad smell’).
- Tagalog word order: *Ma-* initial adjectives—i.e., “prototypical” adjectives—prefer the predominant adjective-noun order.

(26) **mabáho**-ng utót > utót na **mabáho**?
 malodorous-LINK fart fart LINK malodorous

6.2 Limiters

- Schacter and Otanes 1972:121: “Limiter adjectives” (e.g., cardinal numbers, ordinal numbers, quantifiers) prefer first position.

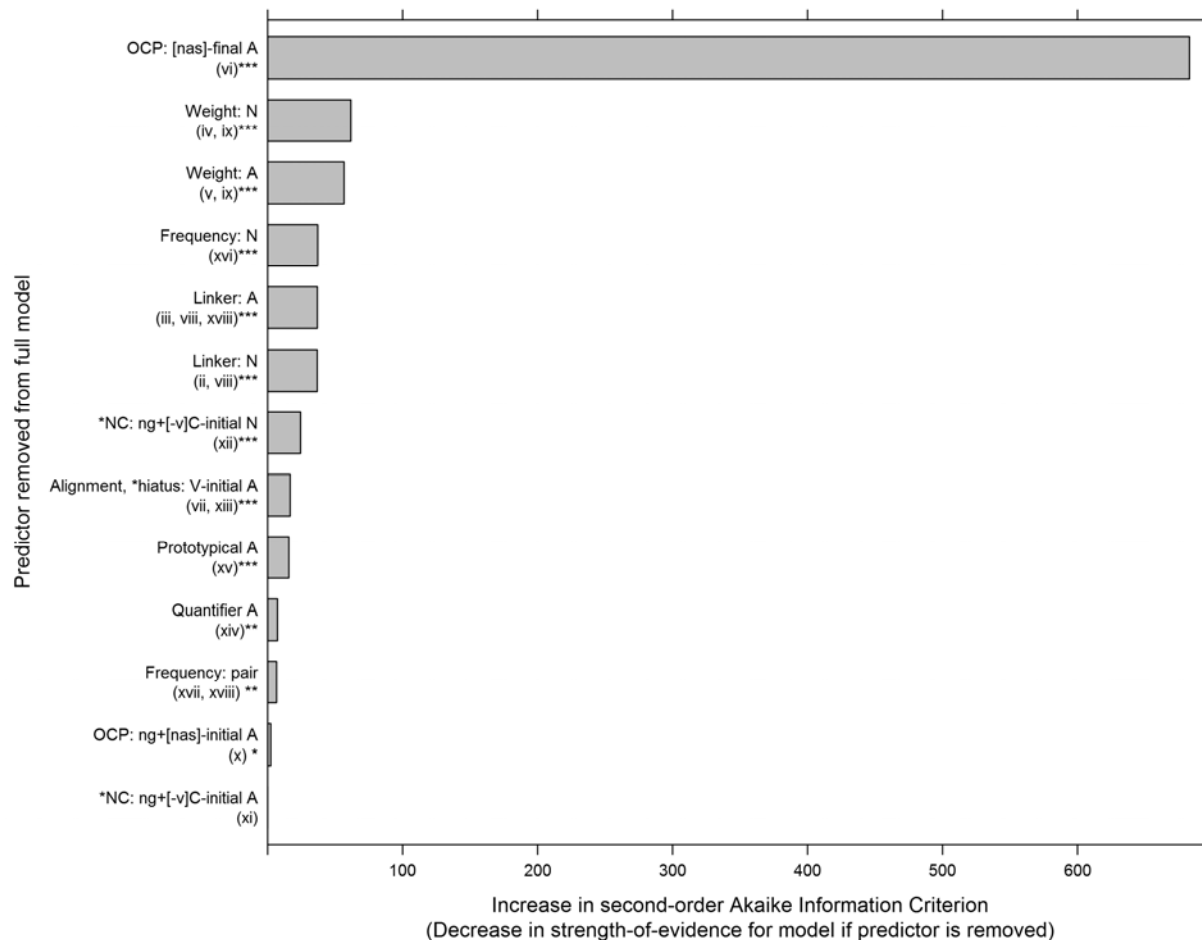
(27) **lahát** na táo > táo-ng **lahát**
 all LINK person person-LINK all ‘all people’

6.3 Frequency

- More frequent nouns prefer initial position.
- Frequency effect for adjectives not reliable (likely because they already prefer first position; also possible ceiling effect of frequency)⁴.
- More frequent adjective/noun pairs prefer canonical, adjective-noun order⁵.

7 RESULTS: COMPARING PHONOLOGICAL VS. NON-PHONOLOGICAL FACTORS

- (28) Akaike Information Criterion (AIC_C) results of predictor importance⁶
(longer bars = more information contributed by predictor to word order choice in data)



⁴ We also found a puzzling interaction between adjective frequency and pair: more frequent adjectives that appear in more frequent adjective/noun pairs (regardless of noun frequency) have a tendency to occur in noun-adjective order ($\beta = 0.007679$, $SE = 0.003173$, $t = 2.42$)

⁵ Pair frequency (how often a given adjective and noun combination occurs) was residualized on both $\log(\text{adjective frequency})$ and $\log(\text{noun frequency})$.

⁶ For more about AIC_C testing, see e.g., Burnham & Anderson 2004.

- Nasal OCP is the most important factor in contributing to word order.
- AIC_C comparisons indicate that many of the phonological conditions are more important when adjective+noun order results in a marked phonological configuration than when noun+adjective order does (e.g., nasal OCP, *NC_o, linker form).
 - → a consequence of a default word order?
- Many of the non-phonological factors (e.g., prototypicality, adjective semantic class) are not as important in predicting word order variation as phonological factors.

8 DISCUSSION

- Our study results show that, controlling for non-phonological predictors, phonological conditions influence adjective/noun word order.
 - ↳ Word order alternations can act as repairs to satisfy phonological conditions (see also Schlüter 2005; Shih 2014; a.o.) ≈ affix order alternations that can satisfy phonological conditions (see e.g., Paster 2005a; Paster 2005b; Yu 2007; Wolf 2008; Kim 2010; though cf. Paster 2009)
- Similar effects of phonology influencing higher-level operations such as word order and construction choices have been demonstrated in other languages.
 - However, large-scale quantitative studies of these types of effects have mostly been limited to English.

8.1 Phonological effects on word order identified

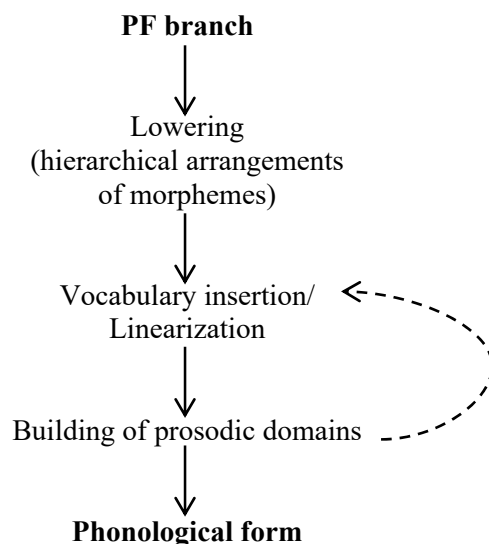
- What type of phonological conditions can affect word order?
 - *Previously identified phonological effects on word order (in other languages)*
 - Phonotactic, OCP
 - Syllable structure optimization (e.g., hiatus avoidance)
 - Prosody: weight, rhythm
 - *Newly identified phonological effects on word order*
 - Contextual markedness (e.g., *NC_o)
 - Phonological and morphological alignment
- Not only can prosodic conditions (e.g., rhythm, weight) affect word order alternations, but also segmental effects do, too.
 - Runs counter to the empirical expectations from approaches that *a priori* exclude the interaction of segmental phonology with morphosyntactic processes (e.g., prosodically-mediated interface: Selkirk 1984; Zec & Inkelas 1990).
- ❖ An alternative hypothesis (see e.g., Shih 2014, to appear): Phonological conditions that tend to affect word order are:
 - ones that hold over syntagmatic configurations within words—i.e., likely to trigger repairs when elements (e.g., words and phrases) (linearly) combine.
 - ones that are also active in the grammar of the language at large—i.e., governing phonotactic and (morpho-)phonological alternations within words (see also e.g., Kenstowicz & Kisseberth 1977; Raffelsiefen 1999; Martin 2011).
- ↳ Conditions that receive support from lexical and morphophonological patterns will be more likely to exhibit effects (and stronger ones) on syntactic behaviors than those that do not.

- ↳ Evidence for the speaker/learner from within-word phonological patterns will tend to generalise into across-word domains in the (probabilistic) grammar of a language.
- ↳ In this way, syntagmatic phonological conditions, which are more familiarly satisfied via phonological optimization, can also be satisfied via morphosyntactic means, like word order alternation.
- Evidence from Tagalog supports this view:
 - Of the two local OCP conditions tested (nasal OCP, velar OCP), only nasal OCP seems to matter, and this is true within static lexical patterns, too. Even though velar OCP is cross-linguistically attested (e.g., in Arabic verb roots: McCarthy 1979; Frisch et al. 2004).
- ❖ Note that even though such a view allows for segmental interaction with morphosyntactic behaviors, it's more restricted than early strawman cases argued by Zwicky & Pullum 1986 to not exist (e.g., “move *x* syntactic constituent when the phrase has a bilabial consonant”).
 - ↳ Our view predicts that only the syntagmatic phonological constraints that carry weight of evidence from phonotactic and phonological alternations in a given language will be the ones that are most likely to condition larger, syntactic phenomena.

8.2 Discussion: Theoretical implications

- Syntax → Phonology generally have a feed-forward relationship in standard formal models of grammar (Zwicky & Pullum 1986) and psycholinguistic models of language production (Levelt 1989; Ferreira & Slevc 2007; cf. Vigliocco & Hartsuiker 2002)
- A more concrete example: in Distributed Morphology (DM), phonological exponence is not available to syntactic operations (late-insertion theory).
- Current question in DM: What is the ordering of linearization and vocabulary insertion, which provides phonological exponents? (see e.g., Embick 2007).
 - linearization prior to phonological information? (Embick & Noyer 2001; Pak 2008)
 - prosodic structure-building interleaved with linearization? (e.g., Tucker 2011)
 - more cycles through PF? (e.g., Embick 2007).

(29) see e.g., Embick & Noyer 2001



- Even if prosodic structure is allowed to interact with linearization, the general assumption is that segmental phonological information in the phonological form is largely unavailable and irrelevant for linearization purposes.

- ❖ **Open question:** How much phonological information is available at the point of linearization? How much phonological encoding occurs before/during grammatical encoding?
- The current study: looks at what happens when there are additional morphophonological processes that compound the problem of available phonological information during linearization.
- Phonologically-conditioned surface form of the linker particle must be available at the time of choice:
 - *-ng* particle preferred, and
 - segmental constraints (e.g., hiatus avoidance, OCP effects) make reference to the surface form.
- ❖ Suggests that effects of word order are in part dependent on knowledge and availability of surface segmental phonological information (not just prosodic structure).
- A possible alternative counter-hypothesis would be that the morphosyntax generates both options equally (i.e., both are viable grammatical alternatives) and then phonology filters.
- *However*, both orders do not appear to be equal options:
 - Adjective-first order is overwhelmingly preferred, even with controls for word, frequency, etc.
 - Phonological structure of adjective-noun order is more closely regulated: a greater number of robust constraints in the model penalize poor phonological structure in adjective-noun order than in noun-adjective order.

9 CONCLUSION

- Presented quantitative study of phonological and (some) non-phonological conditions on adjective/noun word order variation in Tagalog.

Results

- Though variable, adjective/noun pairs exhibit a canonical order preference for adj+noun.
- Phonological conditions, both segmental and prosodic, influence adjective/noun word order preference.
- The phonologically-determined surface allomorph of the linker particle affects adj/noun order choice.
- ❖ Word order variation can be used to optimize phonological well-formedness, suggesting that phonological info factors into considerations of linearization, word order, and/or grammatical encoding.

Next directions

- Variation with linker particle:
 - Variation in linker realization: bare adjective/noun pairs without linker are rare but do occur.
 - Variation in linker surface form: e.g., Richards 1999 reports that some speakers accept linker *na* when *-ng* is called for phonologically, but this only occurs in noun-adjective order.
 - Open questions: What conditions such linker variation? and how does it interact with word order variation?
- Variable versus frozen adjective/noun pairs
 - Mollin 2012: Obeying well-formedness preferences that condition variable word order can cause word orders to become frozen → frozen word orders obey well-formedness preferences to a greater extent than their variable counterparts.
 - Do adjective/noun pairs in Tagalog that exhibit less reversibility demonstrate more adherence to the conditions on word order presented here?
 - May shed light on how phonological effects on word order may become grammaticalized over time.

To save trees, references available here: http://cogsci.ucmerced.edu/shih/ShihZuraw_CAMP2016.pdf

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